

Cathie
Cotton

Sampling and Analysis Plan

for the ...

Remedial Investigation and Feasibility Study

of the ...

Albion-Sheridan Township Landfill
Albion, Michigan
May, 1992

prepared for ...

U.S. Environmental Protection Agency
Region V
Chicago, Illinois

EPA Contract No. 68-W8-0079
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WW Engineering & Science Project No. 04011

US EPA RECORDS CENTER REGION 5



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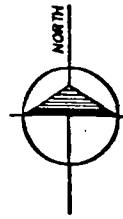
PROPOSED WELLS FOR ALBION-SHERIDAN TOWNSHIP LANDFILL - PHASE I

			DESCRIPTION OF SCREENED INTERVAL
WELL LOCATION	WELL ID	SCREENED INTERVAL(ft)	
MW-1	SG*	32.5-37.5	Approximately 2 feet below the water table.
	WB	54-59	Opposite zone of high conductivity identified during geophysical logging.
	SB*	67.5-72.5	In shallow bedrock.
MW-2	SG*	29-34	Approximately 2 feet below the water table.
	WB	48-53	Opposite zone of high conductivity identified in MWs-1, 3 & 4 during geophysical logging.
	SB*	60-65	In shallow bedrock.
MW-3	SG*	37-42	Approximately 8 feet below the water table in zone of higher conductivity with freons.
	WB*	54-59	Opposite zone of high conductivity identified during geophysical logging.
	SBA*	64.5-69.5	In shallow bedrock.
MW-4	SG	31.5-36.5	Approximately 2 feet below water table and opposite zone of higher conductivity observed during geophysical logging.
	WB*	56-61	Opposite zone of high conductivity identified during geophysical logging.
	SB*	68-73	In shallow bedrock.
	DB*	95-100	Approximately 20 feet below shallow bedrock well in which higher conductivity and low Eh were measured.
MW-5	SG*	23-28	Approximately 2 feet below the water table.
	SB*	70.5-75.5	In shallow bedrock.
MW-6	SG	23-28	Approximately 2 feet below the water table.
	WB*	46.5-51.5	Opposite zone of higher conductivity observed during vertical sampling and zone of higher conductivity observed in MW-4.
	SB*	70.5-75.5	In shallow bedrock.
MW-7	SG	***	Approximately 2 feet below the water table.
	WB	***	Opposite zone of higher conductivity observed during vertical sampling and zone of higher conductivity observed in MW-4.
	SB	***	In shallow bedrock.
MW-8	SG	31-36**	Approximately 2 feet below the water table.
	WB	47-52**	Set in stratigraphic zone in which higher conductivity was identified in MWs-1,3 & 4 during geophysical logging.
	SB	59-64**	In shallow bedrock with top approximately 10-15 feet below depth of auger refusal.
MW-9	SG	12-17**	Approximately 2 feet below the water table.
	WB	27-32**	Set in stratigraphic zone in which higher conductivity was identified in MWs-1,3 & 4 during geophysical logging.
	SB	39-44**	In shallow bedrock with top approximately 10-15 feet below depth of auger refusal.
MW-10	SG	3-6**	Approximately 2 feet below the water table.
MW-11	SG	3-6**	Approximately 2 feet below the water table.
MW-12	SG	3-6**	Approximately 2 feet below the water table.
MW-13	SG	3-6**	Approximately 2 feet below the water table.
LF-2		23-28**	Screen straddling water table, downgradient (southwest) of partially buried drums.(approx. N5950 E4760)
LF-3		25-35**	Boring in central portion of southern half of landfill. Screened only if water table lies above base of fill. (approx. N5500 E4600)

* Well is installed.

** Screened intervals estimated based on existing shallow bedrock wells and/or estimated depth of water table, actual depths subject to change.

*** Approval of well location by landowner pending, depth of screen can be estimated after location is selected.



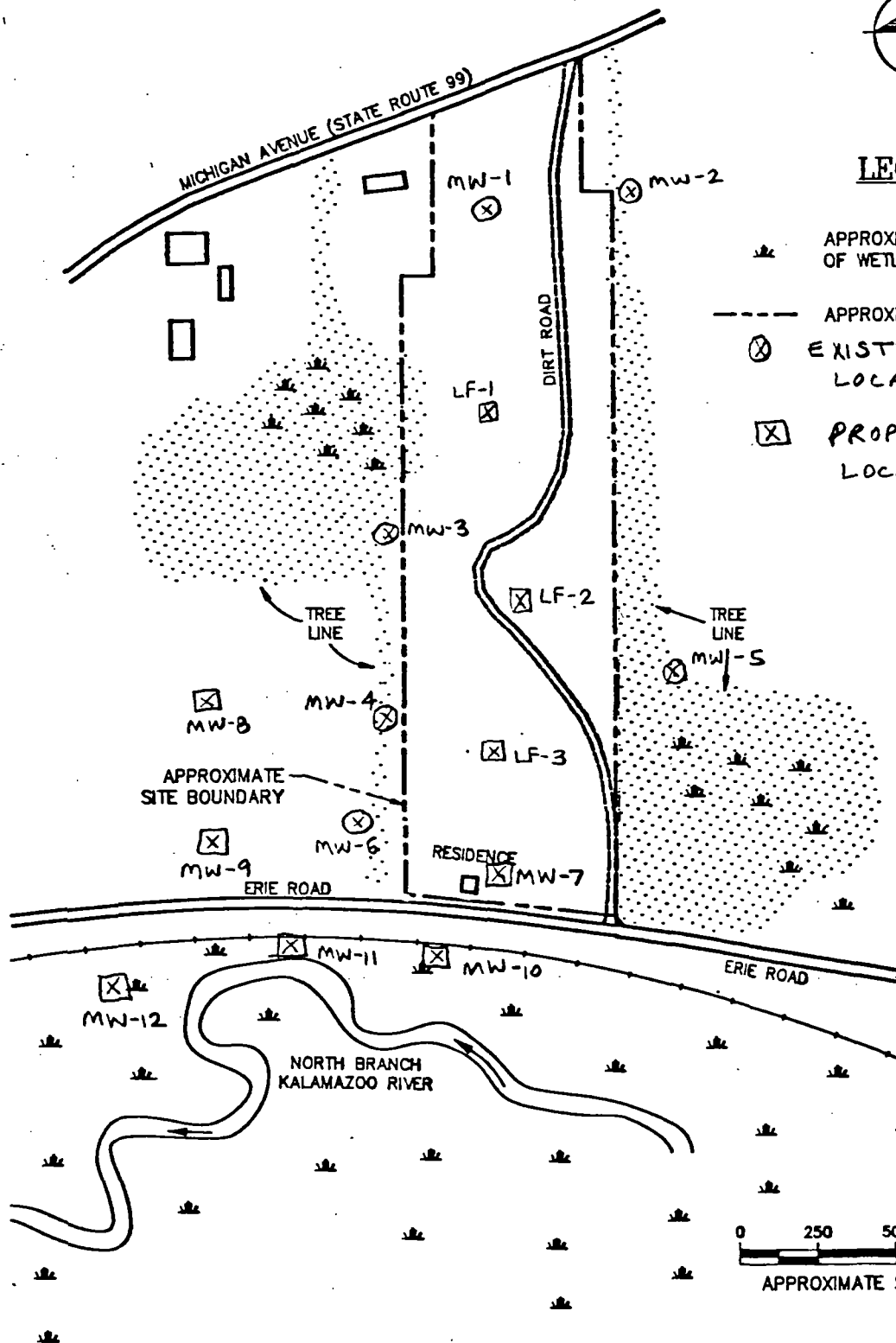
LEGEND

APPROXIMATE LOCATION OF WETLAND AREA

APPROXIMATE SITE BOUNDARY

EXISTING WELL LOCATION

PROPOSED WELL LOCATION



0 250 500 1000
APPROXIMATE SCALE IN FEET

04011-X
VR022092

MONITORING WELL LOCATION MAP Phase I

ALBION-SHERIDAN TOWNSHIP LANDFILL
ALBION, MICHIGAN

Nov. 19, 1992

04011

using a stainless steel spatula. A summary of the number of samples and DQO for each chemical analysis is provided in Table 1.

At 5-foot intervals during sampling of materials above the water table, qualitative measurements of methane gas emanating from the augers will be taken. The measurements of methane gas will be taken with a methane-specific Draeger tube. Procedures for sampling and measuring for methane will be conducted in accordance with the manufacturers instructions.

A minimum of 1 and maximum of 2 samples from each landfill characterization borehole (maximum 6 samples total) will be submitted for chemical analyses as summarized in Table 1. Duplicate samples and trip blanks (deionized water blanks) will also be prepared and submitted for laboratory analysis in accordance with WWES' "Field QC Sample Guidelines" SOP. One duplicate sample will be submitted for every 10 investigative samples. Trip blank samples will accompany each cooler containing VOC samples. If a potential hot spot is encountered, a sample of this material may be submitted for TCLP metals analysis in order to evaluate appropriate remedial alternatives. Any boring requiring abandonment will be grouted from the bottom of the borehole to the ground surface with a cement/bentonite grout in accordance with WWES' "Soil Boring Grouting" SOP.

2.3.1.2 Leachate Monitoring Wells

While drilling the 3 landfill characterization borings, if the water table is encountered before the base of the landfill refuse, a monitoring well will be installed to collect a representative sample of the landfill leachate. The leachate monitoring wells will also provide a means of collecting water level measurements from within the landfill which will be beneficial for accurately characterizing ground water flow characteristics in the vicinity of the site and in calculating the percentage of saturated landfill refuse.

Leachate monitoring wells will be constructed of 2-inch diameter polyvinyl chloride (PVC) and the base of the well screen will be installed at the base of the landfill refuse. The screen in each leachate monitoring well will be 10-feet long and have 0.010-inch (10 slot) openings as supplied from the factory. The leachate wells will be installed through hollow stem augers in accordance with WWES' "Installation of Permanent Monitoring Wells through Hollow Stem Augers". A vented cap will be used on the top of each leachate well casing, and a locking protective steel casing will be installed over each well. The identification number of each well will be clearly marked on the well with weather-resistant materials.

Each of the leachate monitoring wells will be developed no earlier than 24 hours after installation. Well development will be done by a method which will result in surging and pumping water back and forth through the well screen in accordance with WWES' "Monitoring Well Purging With a Bladder, Keck, or Electric Submersible Pump" or "Monitoring Well Purging with a Suction Ditch Pump" SOPs. The wells will be developed until at least 3 to 5 well volumes have been evacuated and pH, temperature, and specific conductivity measurements have stabilized to within 10 percent for two successive well volumes. The pH and conductivity in each sample will be measured in accordance with WWES' "Standard Operating Procedure for Field Determination of pH" and "Standard Operating Procedure for Field Determination of Conductivity, Method 205" SOPs, respectively. Well volumes will be calculated in accordance with WWES' "Well Casing Volume Calculation" SOP.

Purged water will be containerized in 55-gallon drums for storage until the ground water analytical results can be reviewed. The drums will be labeled according to which well the water was collected and stored within a secured area until their ultimate fate can be determined. All details concerning well development including date, time, method and amount of water evacuated will be recorded by WWES personnel in a bound field logbook or on well data sheets.

Leachate samples will be collected on 2 occasions from each leachate monitoring well and submitted for chemical analyses as summarized in Table 2. Samples will be collected following WWES' "Monitoring Well Sampling with a Bailer" SOP. As the samples are collected, the pH, specific conductivity, and oxidation-reduction potential (Eh) of each sample will be measured in accordance with WWES' "Standard Operating Procedure for Field Determination of pH", "Standard Operating Procedure for Field Determination of Conductivity, Method 205", and "Field Determination of Oxidation/Reduction Potential (Eh)" SOPs, respectively. The temperature of each sample will also be measured at the time of collection. Samples collected for analysis of Target Analyte List (TAL) inorganics will be filtered at the time of collection using a 0.45-micron membrane filter. If the sample characteristics are such that the sample cannot be filtered, it will be sent as an unfiltered sample. Samples collected for analysis of TAL cyanide will not be filtered. Duplicate samples and deionized water blanks, including field blanks and trip blanks, will also be prepared and submitted for laboratory analysis in accordance with WWES' "Field QC Sample Guidelines" SOP. One field blank and 1 duplicate sample will be submitted for

every 10 investigative samples. Trip blank samples will accompany each cooler containing VOC samples.

The decision to classify the leachate water as either low or medium concentration will be made in the field. If the water is either discolored, viscous, then the sample will automatically be considered medium concentration. The water will be collected in containers appropriate for medium concentration, left unpreserved, and sent as medium concentration for purposes of adhering to proper appropriate shipping procedures.

If the water is clear, one to two average aliquots of preservative will be added to the sample in accordance with those specified for low concentration samples. If upon preservation, there appears to be a reaction with the preservative (the sample becomes warm or effervesces) or the pH does not change significantly, then the sample will be sent as a medium concentration sample. If no reaction occurs, the samples will be appropriately preserved and sent as low concentration samples. When scheduling these samples with Sample Management Office, they will be identified as leachate so that the lab will be notified and prepared to analyze these samples appropriately. Additionally, the lab will be requested to screen the samples prior to analysis to assess whether they are actually low or medium concentration.

All pertinent information concerning preservation of these samples will be recorded on the sample container, sample tag, and TR/COC.

~~Note that any multi-phase sample is automatically a high concentration sample and cannot be shipped to RAS labs or the generic SAS labs. Also, the low-level generic SASs may not be effective on these leachate samples; these samples may not be able to be analyzed for the water quality parameters.~~

IMPORTANT

The model will have the capacity to test the effect of potential remedial options (for example, recovery wells, trenches, slurry walls) and if ground water treatment includes purging, to provide estimates of the time required for different constituents of concern.

2.4.4 GROUND WATER SAMPLING

2.4.4.1 Ground Water Sampling Locations and Parameters

Two ground water samples will be collected at each monitoring well in order to evaluate the impact of the landfill on the aquifers beneath the site. The proposed monitoring well locations are illustrated in Figure 3. The monitoring wells will be installed as described in Section 2.4.2. Installation and development activities will be completed at least 72 hours before ground water sampling activities commence at each well. Up to 37 monitoring wells may be installed and sampled at the site.

Ground water samples will be collected on 2 occasions from each monitoring well and submitted for chemical analyses as summarized in Table 6. The results of the first set of analyses will be evaluated to determine which samples from the second set should be submitted using the low detection limit residential well Special Analytical Services (SAS) request. Ground water which, based on the first analytical set, has very low or detectable levels of Target Compound List (TCL) organics and TAL inorganics, will be selected for the SAS analysis during the second set of analyses. This will allow for screening for compounds at lower detection limits to achieve compliance with Michigan Act 307 detection limit requirements.

2.4.4.2 Ground Water Sampling and Equipment Procedures

Ground water samples will be collected using a Teflon bailer following WWES' "Monitoring Well Sampling with a Bailer" SOP. To prevent the loss of contaminants while sampling, a bottom-emptying device will be utilized on the bailer when collecting samples to be analyzed for organics. Shallow monitoring wells will be purged prior to sampling with a clean Teflon bailer. In the deeper monitoring wells, purging prior to sampling with the bailer will be accomplished using a Keck pump following WWES' "Monitoring Well Purging with a Bladder, Keck, or Electric Submersible Pump" SOP. All wells will be purged of at least 3 casing volumes prior to sampling. Upon completion of purging, the temperature, pH, specific conductivity, and Eh of each sample will be measured. Measurements of the pH, specific conductivity, and Eh of each sample will be measured in accordance with WWES' "Field Determination of pH", "Field Determination of Specific Conductivity, Method 205",

and "Field Determination of Oxidation/Reduction Potential (Eh)" SOPs, respectively. Samples collected for analysis of TAL metals will be filtered at the time of collection using a 0.45-micron membrane filter. Samples collected for analysis of TAL cyanide will not be filtered. All sampling equipment will be decontaminated between use following WWES' "Decontamination Down-hole Sampling Equipment" SOP.

2.4.4.3 Vertical Ground Water Sampling

Ground water samples will be collected from the bedrock aquifer during coring of the deep bedrock well (MW-6) at the downgradient location. Samples will be collected for each 10-foot interval cored. After a 10-foot interval of rock has been cored, that section of bedrock will be isolated by using a packer at the top of the interval. At least three 10-foot corehole volumes will be purged from the sampling interval prior to sample collection. Specific conductivity, temperature, and pH will be measured periodically while purging to document that these parameters have stabilized prior to collecting a sample. Measurements of the pH, Eh, temperature, and specific conductivity will be taken, and a scan for volatile organic compounds listed in Table 7 will be performed with a gas chromatograph (GC) at the time each sample is collected. If the field measurements or GC scan indicate evidence of contamination is present, coring will continue. If no contamination is detected with these field analyses in 2 successive 10-foot rock intervals, or the corehole has been sampled to a depth of 120 feet, coring will cease and a well will be set as described in Section 2.4.2.2.

Ground water samples will be collected at 5-foot intervals while drilling through glacial deposits at 3 locations, (MW-3, MW-4, and MW-6) during installation of the 6 initial bedrock monitoring wells. Sampling will be accomplished through temporary monitoring wells in accordance with WWES' "Temporary Wells Through Hollow Stem Augers" SOP.

Measurements of pH, Eh, temperature, and specific conductivity will be taken in the field, and a field scan for VOCs will be performed with a GC at the time each sample is collected. The field scan for VOCs will include the parameters listed in Table 7. Scanning will be performed in accordance with WWES' "Field Analyses for Volatile Organics in Ground Water" SOP.

2.5 SURFACE WATER INVESTIGATIONS

Twelve surface water samples will be collected from the North Branch of the Kalamazoo River. Six samples (3 pairs) will be collected from areas downstream of the site and six samples (3 pairs) will be collected from upstream areas. Eight surface water samples will be

TABLE 2
SUMMARY OF LEACHATE WATER SAMPLING AND ANALYSIS PROGRAM
ALBION-SHERIDAN TOWNSHIP LANDFILL

NUMBER OF QUALITY ASSURANCE SAMPLES									
SAMPLE MATRIX	LABORATORY PARAMETERS(1)	DQO(2) ANALYTICAL LEVEL	NUMBER OF INVESTIGATIVE SAMPLES	DUPLICATES	FIELD BLANKS	TRIP BLANKS	TOTAL BLANKS(3)	MS/MSD (4)	TOTAL SAMPLES
Leachate Water (Low or Medium Hazard)	TCL organics package from CLP (1st round)	IV	3	1	1	0	1	1	5
	TCL organics package from CLP VOA's only (Blank samples only, 1st round)	IV	0	0	0	1	1	0	1
	TAL inorganics from CLP (1st round)	IV	3	1	1	0	1	0(5)	5
	SAS TOC (1 round only)	V	3	1	1	0	1	1	5
	SAS COD (1 round only)	V	3	1	1	0	1	1	5
	SAS BOD (1 round only)	V	3	1	1	0	1	0	5
	SAS TSS (1 round only)	V	3	1	1	0	1	0	5
	SAS TDS (1 round only)	V	3	1	1	0	1	0	5
	SAS Oil and Grease (total from both rounds)	V	6	2	2	0	2	0	10
	SAS Chloride (total from both rounds)	V	6	2	2	0	2	2	10
	SAS Sulfate (total from both rounds)	V	6	2	2	0	2	2	10
	SAS Nitrate (total from both rounds)	V	6	2	2	0	2	2	10
	SAS Ammonia (total from both rounds)	V	6	2	2	0	2	2	10
	SAS TKN Nitrogen (total from both rounds)	V	6	2	2	0	2	2	10

(1) In addition to the laboratory parameters, pH, Eh, specific conductivity and temperature measurements will be taken in the field for each sample collected.

(2) DQO - Data Quality Objective.

(3) The number of blanks are estimated only. The number may vary depending on field conditions. The blank samples will be a deionized water matrix.

(4) MS/MSD - Matrix spike/matrix spike duplicate. MS/MSD samples are not counted into the total number of samples. One MS/MSD sample will be collected for every 20 or less samples.

(5) QA/QC for TAL inorganics includes MS/sample duplicate.

TABLE 6
SUMMARY OF GROUND WATER SAMPLING AND ANALYSIS PROGRAM
ALBION-SHERIDAN TOWNSHIP LANDFILL

SAMPLE MATRIX	LABORATORY PARAMETERS ⁽¹⁾	DQO ⁽²⁾ ANALYTICAL LEVEL	NUMBER OF INVESTIGATIVE SAMPLES	NUMBER OF QUALITY ASSURANCE SAMPLES					TOTAL SAMPLES
				DUPLICATES	FIELD BLANKS	TRIP BLANKS	TOTAL BLANKS ⁽³⁾	MS/MSD (5)	
Ground Water (Low Hazard)	TCL organics package from CLP (1st round)	IV	37	4	4	0	4	2	45
	SAS Low Level Organics Package or TCL from CLP (2nd round) ⁽⁴⁾	V, IV	37	4	4	0	4	4 ⁽⁷⁾	45
	TCL organics package from CLP VOA's only (Blank samples only, 1st round)	IV	0	0	0	10	10	0	10
	SAS Low Level Organics Package, or CLP for VOA's only (Blank Samples only, 2nd round) ⁽⁴⁾	V, IV	0	0	0	10	10	0	10
	TAL inorganics from CLP (1st round)	IV	37	4	4	0	4	0 ⁽⁶⁾	45
	SAS Low Level Inorganics or TAL from CLP ⁽⁴⁾ (2nd round)	V, IV	37	4	4	0	4	4	45
	SAS TOC (1 round only)	V	37	4	4	0	4	4	45
	SAS COD (1 round only)	V	37	4	4	0	4	4	45
	SAS BOD (1 round only)	V	37	4	4	0	4	0	45
	SAS TSS (1 round only)	V	37	4	4	0	4	0	45
	SAS TDS (1 round only)	V	37	4	4	0	4	0	45
	SAS Oil and Grease (1 round only)	V	37	4	4	0	4	0	45
	SAS Chloride (total from both rounds)	V	74	8	8	0	8	8	90
	SAS Sulfate (total from both rounds)	V	74	8	8	0	8	8	90
	SAS Nitrate (total from both rounds)	V	74	8	8	0	8	8	90
	SAS Ammonia (total from both rounds)	V	74	8	8	0	8	8	90
	SAS TKN Nitrogen (total from both rounds)	V	74	8	8	0	8	8	90

(1) In addition to the laboratory parameters, pH, Eh, specific conductivity and temperature measurements will be taken in the field for each sample collected.

(2) DQO - Data Quality Objective.

(3) The number of blanks are estimated only. The number may vary depending on field conditions. The blank samples will be a deionized water matrix.

(4) Based upon the results of the 1st round analyses, the 2nd round can be analyzed using either CLP or low level residential SAS.

(5) MS/MSD - Matrix spike/matrix spike duplicate. MS/MSD samples are not counted into the total number of samples. One MS/MSD sample will be collected for every 20 or less samples.

(6) QA/QC for TAL inorganics includes MS/sample duplicate.

(7) Performance Evaluation Samples (PES) if SAS is used.

Ground Water Bottle Requirements - TCL/TAL*

VOCs

two 40 ml glass vials
HCl <2
14 days holding

ABNs/BNAs/Pest/PCB

two 80 oz amber glass
ice
7 days holding

Metals

one 1 liter poly
5 ml 50% HNO₃
6 months holding
(filtered)

Cyanide

one 1 liter poly
5 ml NaOH
14 day holding
(not filtered)

Chloride/Sulfate

one 1 liter poly
ice
28 day holding

TOC, COD, Ammonia, TKN

two 1 liter poly
1 ml H₂SO₄ to pH<2
28 day holding

BOD

one 500 ml poly
ice
48 hours holding - ship daily

TSS/TDS

one 1 liter poly
ice
7 day holding

Oil and Grease

one 1 liter amber glass
1 to 2 ml H₂SO₄ to pH<2
28 days

Albion Laboratories

General Water Quality Parameters - TSS, TDS, etc.

SAS 7652E

PBS&J Environmental Laboratory
6635 E. Colonial Drive
Orlando, Florida 32807
Attn. Don Frison
Phone 407-277-4443

Low concentration - Organics

Case 19266

American Analytical and Technical Serv.
1700 West Albany, Suite A
Broken Arrow, OK 74012
Attn. Missy Hamby
918-251-0545

Low concentration - Inorganics

Case 19266

Keystone Lab - Houston
8300 West Park Drive
Houston, TX 77063
Attn. Dela Massoudi
713-266-6800

Medium concentration - Organics - Water from LF1

Case 19266

Southwest Research Institute
6220 Culebra Road
San Antonio, TX 78238
Attn. Joann Lawless Boyd
512-522-2169

Medium concentration - Inorganics - Water from LF1

Case 19266

Chester Labnet, Keystone - Lab Monroeville
3000 Tech Center Drive
Monroeville, PA 15146
Attn. Maureen Donlin
412-825-9776

DECONTAMINATION, DOWNHOLE SAMPLING EQUIPMENT

This guideline consists of minimum requirements for the decontamination of split-spoon sampling devices, temporary well materials, augers, and water sampling bailers used at hazardous waste sites for obtaining samples to be analyzed in the laboratory.

The requirements apply foremost to equipment being used to obtain samples for the laboratory and, therefore, are intended to minimize incidents of cross-contamination of samples. The requirements also apply to the auger where contaminated soils are sampled only for on-site identification purposes. This is to avoid cross-contamination of locations. The requirements apply to the auger, particularly when moving from a "dirty" to a "clean" location.

ANALYTE TYPES

Different decontamination steps are recommended for different kinds and physical states of analytes. The analyte types for this purpose are:

- **inorganics**--major dissolved ions, along with heavy metals.
- **dissolved organics**--organics as aqueous species, no "free" organic phase present.
 - (1) *soluble organics*--ketones, alcohols, ethers, and others that are fairly to infinitely soluble in water
 - (2) *VOC's*--sparingly soluble
 - (3) *semi-volatiles*--sparingly soluble
 - (4) *PCB's and pesticides*--nearly insoluble in water, but very soluble in oil
- **free organics**--a visible or suspected organic liquid phase. This is usually not an analyte, but when present interferes with analysis of the aqueous phase compounds and presents a strong potential for cross-contamination.
- **combination**

The decontamination procedures apply to equipment in contact with analytes whether present within a soil matrix or as a "free" liquid.

DECONTAMINATION FREQUENCY

The lead auger (and any flites affected by formation heave) should be decontaminated between each location. The split-spoon sampler, temporary well materials, and bailers should be decontaminated between each use. Well evacuation followed immediately by sampling would be considered a single use of a bailer. If two or more wells are consecutively evacuated prior to any sampling, or if there is a delay between evacuation and sampling the well, the bailer should be decontaminated after each evacuation. With a

few exceptions to be mentioned, all named equipment should receive the same kind of decontamination.

DECONTAMINATION PROCEDURES

The recommended decontamination steps are given in the accompanying table.

Where soluble organics, VOC's or semi-volatiles are present, the least time consuming decontamination method is steam cleaning. Although tap water is typically used for steam cleaning, no final DI rinse should be required because the steam should be at an elevated temperature which enhances the removal of volatiles. Steam cleaning should be always conducted at "live steam" temperatures, which exceed 212°F. Be sure the steamer water is taken from a public water supply or a source of known and approved quality. If you know or suspect that unvaporized water is carrying over, use a final DI rinse or halt work until the steamer is performing as it should. Also, be sure the steam delivery wand is of sufficient length to deliver live steam to remote points (e.g., center of 20-foot pipe section).

The inorganics and heavy metals call for an initial soapy wash, tap water rinse, dilute acid rinse, and a final DI rinse. The "soap" for the soapy wash can be a TSP (trisodium phosphate) product. If phosphate or phosphorus is an analyte, or otherwise disadvantageous, a low-phosphate detergent, such as Alconox, may be used, followed by a dilute acid rinse and a DI rinse. The dilute acid for the inorganic rinse, and to remove any traces of phosphate detergent where necessary, can be reagent grade nitric or hydrochloric acid of 0.01 normal strength.

The PCB's, pesticides, and free organic phase contaminants call for solvent rinses following a soapy wash, and immediately preceding the final DI rinse. An alternative to performing the final DI rinse following a methanol or acetone rinse is to apply live steam to the equipment to volatilize these compounds.

DISPOSAL OF DECONTAMINATION WATERS

In general, all spent wash and rinse waters including organic rinse liquids will be contained to prevent them from being returned to the ground. All decontamination liquids, along with other incidental waters such as well-development or well evacuation water, will be appropriately disposal. Disposal arrangements or plans will be developed prior to the work, where feasible, and with the client's input and concurrence. Appropriate disposal for liquids, **except for hexane**, may involve disposal to a sanitary sewer or disposal to an industrial wastewater treatment system.

RECOMMENDED FREQUENCY OF CHANGING SOAPY WASH WATER AND TAP WATER

The cleanest way to perform soap and tap water decon is to have a squirt bottle, sprayer or other applicator for the soapy water, and a flowing stream of tap water. In this manner, the soapy water and tap water "reservoirs" are always clean, and equipment comes in contact with clean solutions only.

If you have to use a tub or dip tank for immersion of equipment in soapy water, the following is offered. Related to the frequency of change is the order in which equipment should be decontaminated. Some general guidelines to minimizing the needed changes:

- Wash cleaner (less soiled or "oily") equipment first.
- Have several split-spoon samplers on hand where practical, to save decontamination time and to allow washing these in a batch before the auger needs to be washed.
- Wash bailers in a dedicated soapy solution. This should not often be inconvenient since drilling/soil sampling is usually done separately from well sampling. Having several bailers on hand can allow batch washing of them before a dirtier piece of equipment needs to be washed.
- Wash temporary well casing and screens in a soapy solution dedicated to these materials only.

If a tap water stream is impractical, change the tap water when it first shows discoloration, floating debris, or foaming tendencies due to soap carryover. Two tap water baths in series, changing out both when the second bath reaches the above condition, will minimize changes.

Change soapy water when you change the rinse bath, sooner if the soapy water shows a slick that is other than detergent film. Change soapy water when the solution is too "spent" to generate soap/detergent foam with moderate agitation. If, before any of the above indications occurs, the soap solution becomes discolored with suspended clay or silt, it becomes a matter of personal judgment. It is a good idea to have sufficient drum capacity on hand to be able to change the soapy water "more" frequently rather than "less". Be sensitive to aesthetics and impression as well, when the client's representatives or regulatory personnel are on site, and be prepared for more frequent changes than your experience might otherwise dictate.

FIELD NOTES/RECORDS

Each week field notes must be copied to the Project Manager, or the Project Engineer/Geologist. Don't invest time in editing or rewriting them; the notes should have been taken throughout the day and, therefore, they should be a sufficiently accurate record in their original form.

The best time to copy the notes would be with the lab copier as you are turning in samples at the lab receiving desk, or, at Eagle Drive when returning equipment.

By providing the copies weekly, the Project Manager will have timely information and can begin to get any of his questions about the notes answered right away.

NOTES MUST INCLUDE:

- 1) Project Name
- 2) Project Number
- 3) Technician's Name
- 4) Date
- 5) Location of Field Activity (for example, Lansing, corner N. Logan and Sunset)
- 6) Materials and Equipment - list, including the quantities on-site at the beginning of each day
- 7) Weather - limited information (sunny, overcast, humid, precipitation, wind, approximate temperature)
- 8) Methods, Brief - "according to work plan". If deviation from plan, you must note what was done differently, why, and the results. You must note whether the deviation was called for by you, or a departure by the contractor. If by the contractor, whether you have approved or disapproved it.
- 9) Problems Encountered - how they were dealt with. Problems include equipment malfunction, delays, unsafe working conditions or procedures, departure from the Health & Safety Plan, attitudes/comments of workers/visitors, weather adversely affecting the work, and inspected work found to be unsatisfactory. Include a sketch of an unusual procedure, if helpful.
- 10) Site Visitors - who and when, their comments
- 11) Location Descriptions - wells, borings, and sampling stations. Distance tie-in to two fixed site facilities.

- 12) Summary of Work Accomplished - For example, locations completed (such as borings B-1, B-9; well 3-A), soil volume removed, depth of drilling in progress.

Concerning the numbered items of information above:

- Record Items 1 through 7 right away. **Item 6 is optional, depending upon the manager and project needs.**
- Record Items 7 through 11 during the day, as any changing weather and site events call for. **Record Item 11 only if locations are not documented elsewhere.**
- Attend to Item 12 at the end of the working day.

Notes must reference any forms used for documenting calculations, location descriptions, depth measurements, and time and materials. For example:

Sampling Calculations--see attached WSFR form

Well/Boring Elevations--see attached survey form

Water Level Data--see attached WL & FR forms

Time and Materials--see attached DT & MR form

Attach the original filled-out forms with copies of the notes.

MONITORING WELL SAMPLING WITH A BAILER

The objective in well sampling is to obtain a representative sample of the ground water from the formation where the well screen has been placed.

JOB DESCRIPTION:

Obtain ground water samples from the specified wells.

TASK-SPECIFIC EQUIPMENT AND MINIMUM INFORMATION NEEDED:

- detailed well location map
- order of the well sampling
(supplied by the project manager)
- polypropylene rope
- bailers
- container for purge water (if required)
- well keys
- total well depth data
- water level tape (electric or steel)
- well pumps if necessary
- previous water level data
- disposable gloves
- sample bottles
- calculator
- $V = Hr^2 (0.163)^a$

^aRefer to guideline for calculating the volume of standing water in a well casing.

EXPECTATIONS:

All water levels will be taken prior to sampling.

All purge volume data will be recorded.

Sound decontamination procedures will be followed.

Noticeable discoloration or odor in the water will be reported.

Each sample requested will be collected.

PROCEDURES:

1. All the wells of a cluster to be sampled are uncapped. Care must be taken not to mix the caps up. The caps should be placed near the well on a clean area, such as a small piece of plastic. Inspect the condition of the well(s).

2. Take a round of water levels. Electric tapes decrease the potential for cross-contamination.
3. Calculate and record the volume of water in the casing. Record the needed purge volume (three times the volume of water in the casing).
4. Purge the well with a clean or dedicated bailer and a new length of polypropylene rope. Concentrate the purging effort at the air/water interface.
5. Record the amount of water actually purged and what was done with the purge water. Record the method of purging, and the type of bailer used (Teflon or stainless steel).
6. Collect the ground water sample with the bailer.
7. Fill the sample container accordingly.
8. Seal the container.
9. If the container is a VOC vial, turn the full container upside down and tap it lightly. Watch for air bubbles. If air is present in the bottle, add more water and recap, again checking for the presence of air bubbles.
10. Label the sample bottle(s) and place in a cooler with ice for transport to the laboratory.
11. Steam clean the bailer before using again.
12. Dispose of the used rope.

In wells which do not readily recover, it may be unreasonable to purge three well casing volumes prior to sampling. In these cases, a field judgment must be made as to what is a "reasonable" amount of time to spend in securing the sample. In a well that can be bailed dry, it is acceptable to purge one casing volume, wait for the well to recover, and take a sample. Keep good records of the volume of water actually purged and estimate the recovery time for the well. The purpose of purging is to remove all the static water from the well. In a well which is bailed dry, that objective is obtained after one well casing volume is removed.

**MONITORING WELL PURGING WITH A
BLADDER, KECK OR ELECTRIC SUBMERSIBLE PUMP**

GOAL:

Remove the required volume of water from a well to obtain a sample representative of the natural ground water quality while avoiding cross-contamination.

TASK-SPECIFIC EQUIPMENT NEEDED:

1. bladder, Keck, or electric submersible pump
2. water level tape
3. 5-gallon bucket

PROCEDURE:

1. Before each well is purged, the outside of the pump and any tubing that goes down the well will be washed with a lab-grade soap, such as Alconox, and rinsed with distilled or deionized water. In addition, some water will be run through the pump to avoid cross-contamination.
2. Measure water level, confirm level with second measurement.
3. Calculate volumes of water to be purged from well. Refer to the well casing volume calculation S.O.P.
4. Lower appropriate pumping unit down the well and position pump intake as near the well water interface as possible. Position outlet hose away from well. It may be necessary to lower the intake hose while purging if the water surface in the well drops as pumping continues.
5. Start pump, note time pumping began, and let pumping rate stabilize before checking flow rate with 5-gallon bucket.
6. Calculate pumping time required to purge desired volume (e.g., 30 gallons @ 5 gal/min = 6 minutes).
7. Sample well with a bailer after each purging (see "Monitoring Well Sampling with A Bailer" procedure).

DOCUMENTATION:

Record: 1) well number, 2) date, 3) priming water used (if any), 4) pumping rate, 5) minutes pumped, 6) volume discharged, 7) sampling method and 8) remarks on ground water sampling record form. Additional data and other forms may be necessary and should be specifically requested by the Project Manager.

MONITORING WELL PURGING
WITH A SUCTION (DITCH) PUMP

GOAL:

Remove the required volume of water from a well to obtain a representative ground water sample while avoiding cross-contamination.

TASK-SPECIFIC EQUIPMENT NEEDED:

1. ditch pump with hoses
2. 5-gallon bucket
3. appropriate plumbing to fit desired well (packers)
4. water level tape
5. electrical tape

PROCEDURE:

1. Before each well is purged, the outside of the pump and any tubing that goes down the well will be washed with a lab grade soap, such as Alconox, and rinsed with distilled or deionized water. In addition, some water will be run through the pump to avoid cross-contamination.
2. Measure water level, confirm with second measurement. If water level is below approximately 22 feet, the ditch pump will probably not work. One casing volume (in gallons) is equal to $3.14 r^2 h$ (7.48) where:

v = volume in gallons
"Pi" = 3.14
r = radius of well in feet
h = height of the water column in the well (refer to well casing volume calculation S.O.P.)
3. Assemble packer unit on well, ensuring a tight seal. Electrical tape may be necessary at the top of the well.
4. Attach hose from ditch pump inlet to packer unit. Position outlet hose from pump away from well.

5. If a drop pipe (or other conduit) is used, the lower end of the pipe should be maintained as close to the well water surface as practical.
6. Start pumping. Note time pumping began. Let pumping rate stabilize before checking flow rate with 5-gallon bucket.
7. Calculate pumping time required to purge desired volume.
8. Sample well with a bailer after purging (see "Monitoring Well Sampling with a Bailer" procedure).

DOCUMENTATION:

Record: 1) well number, 2) date, 3) priming water used (if any), 4) pumping rate, 5) minutes pumped, 6) volume discharged, 7) sampling method, and 8) remarks on ground water sampling field record form. Additional data and other forms may be necessary and should be specifically requested by the Project Manager.

WATER LEVEL MEASUREMENT

There are two devices that are acceptable for measuring water levels. These are a steel tape and water-soluble carpenter's chalk, and an electric tape. While the electric tape reports measurements to 0.01 foot, it is less accurate than the steel tape method; therefore, the steel tape method should be preferred over the electric tape.

For some applications, the electric tape is preferred. An electric tape gives an accurate measurement to the water without actually going into the water. The electric tape is less likely to cross contaminate between wells that are to be sampled. Since the electric tape only touches the water, it is easier to decontaminate after a water level measurement is taken. Water levels are obtained more quickly than with a steel tape.

The steel tape and chalk method is very accurate. This method, however, is a little less desirable for measuring water levels on wells that are to be sampled. The steel tape method introduces chalk to the water, the tape becomes rusted, and it is necessary to submerge a small portion of the tape to obtain a correct measurement.

The standard procedure for taking a water level measurement, whether using an electric tape or steel tape and chalk, is basically the same.

JOB DESCRIPTION:

Obtain a round of water levels.

TASK-SPECIFIC EQUIPMENT AND MINIMUM INFORMATION NEEDED:

- steel water level tape or electric water level indicator
- water-soluble carpenter's chalk
- paper towels
- hand-held engineer's measuring tape
- well location map
- well keys
- previous water level or water elevation data

EXPECTATIONS:

Water levels will be taken at all the indicated wells and recorded to the nearest 0.01 foot.

Document the time, date, and the method of the measurement.

PROCEDURES FOR A STEEL TAPE AND CHALK:

1. Uncap all the wells of a cluster to be measured to allow the water levels to stabilize. Be sure to place the well caps on a clean area (use visqueen if necessary). Vented well caps should provide for minimum (essentially zero) time for water level stabilization.
2. Smear the graduated portion at the end of the tape with chalk.
3. Carefully lower the tape into the well until the chalked portion of the tape intersects the water in the well.
4. Advance the tape until the nearest one-foot increment of the tape is exactly even with the top-of-casing; record.
5. Recoil the tape from the well and read the water level measurement directly from the wetted portion of the tape; record.
6. Dry the tape with a paper towel and resmear it with chalk, and take a second, confirmation measurement; record.
7. Clean the tape before proceeding to the next well.
8. Replace the well cap.

PROCEDURES FOR AN ELECTRIC WATER LEVEL INDICATOR:

1. Uncap the wells.
2. Carefully lower the tape into the well.
3. The buzzer will sound as the probe hits the water. Once the buzzer has sounded, slowly pull the tape up until the buzzer turns off.
4. Read the measurement from the top-of-casing and record it.
5. Take a second measurement to confirm; record it.
6. Clean the tape before proceeding to the next well.
7. Replace the well cap.

Each time a water level measurement is taken, a second confirmation reading is necessary to ensure that the water level is stable. If the second measurement is within ± 0.01 feet of the first, the measurement is good and can be recorded as a stable water level. If the second measurement does not confirm the first, then wait for the well to stabilize and try again.

Indicate in your field notes if the measurements were taken after or during a period of rainfall. Be alert to any irregularities observed which may have an affect on the water levels (such as a nearby pumping well).

Always record the date, time and method of each measurement.

If the measurement references a "holding point" other than the top of the casing, or you are unsure of which point is the top of casing, indicate the reference point used, measure the difference between the top-of-casing and the reference point, and provide a diagram.

WELL CASING VOLUME CALCULATION

Minimum information and equipment necessary to perform the task:

- well location map
- total depths of the wells
- water level tape
- calculator

Well casing volumes are important to determine the volume of water which must be purged from a well prior to collecting a groundwater sample which is representative of the screened aquifer. Obtaining this value is a two-step calculation:

$V = \text{"Pi"} r^2 H (7.48)$ is the equation for the volume of a cylinder and is used to make the volume calculation:

ONE:

where:

V =	volume of water in the casing (cubic feet)
"Pi" =	3.14
r =	radius of well (<i>feet</i>)
H =	height of the water column in the well (feet)
7.48 =	converts volume (V) from cubic feet to gallons

It is necessary to evacuate at least three volumes of water before sampling; therefore:

TWO: $V \times 3$ = volume of water to be purged prior to sampling

A simplified form of the equation for the volume of the cylinder is:

$$V = r^2 H (0.163)$$

where:

V =	volume of water in the casing (gallons)
r =	the inside radius of the well casing (<i>inches</i>)
H =	the height of the water column in the well (feet)
	$H = H_o - H_1$
	H_o = total length of the well measured from TOC
	H_1 = the water level measured from TOC
0.163 =	a constant

Carefully avoid the possibility of cross-contamination between wells by rinsing water level tape off between wells.

STANDARD OPERATING PROCEDURE FOR FIELD DETERMINATION OF PH

GROUND WATER, SURFACE WATER AND LEACHATE ANALYSIS

1.0 Method Summary

- 1.1 This is a determination of the activity of the hydrogen ions by potentiometric measurement.

2.0 Interferences

- 2.1 Temperature is an important factor. The temperature compensator attached to the instrument automatically corrects the pH value displayed by the meter.

3.0 Instrumentation

Beckman pH meter
pH probe
Automatic Temperature Compensator (ATC)

4.0 Materials and Reagents

Sample cups
Prepared pH 4 and 10 standards for calibration

5.0 Calibration

During initial setup and calibration, two standards are run.

Standardizing the Instrument

- 5.1 Depress the CLEAR key to clear the instrument.
- 5.2 Rinse the electrode with distilled water and immerse in pH 4 buffer. Depress the STANDARD key. When the input from the electrode is stable, the instrument will automatically standardize on the pH value of 4.00 pH buffer. The STD1 symbol and the approximate value of the pH 4.00 buffer will appear in the DISPLAY.
- 5.3 Rinse the electrode with distilled water and immerse in pH 10 buffer. Depress the STANDARD key again. When the instrument stabilizes, the DISPLAY will include STD1, STD2, temperature, and the approximate value of the pH buffer 10.

- 5.4 The instrument is now ready to make a pH measurement. Rinse the electrode with distilled water and immerse in the sample.
- 5.5 Depress the pH key. Wait until the AUTO symbol flashes and then locks. The DISPLAY will indicate the measured temperature and pH.
- 5.6 This sequence can be repeated for additional pH measurements. Depress the pH key, wait for AUTO READ to lock, and note the pH value.
- 5.7 A ± 0.05 pH acceptance limit should be used in determining calibration acceptability. If unacceptable, recalibrate as described in 5.1.

6.0 Procedure

- 6.1 Prepare and analyze samples without delay.
- 6.2 Place about 50 mls of sample into a plastic cup and stir with the pH probe.
- 6.3 Allow the pH reading to stabilize. Collect three pH readings from each sample within ± 0.5 units. Record the pH values on the well or surface water sampling record form. Rinse the probe with distilled water and verify calibration by submersing in a prepared pH standard as described in 5.7.
- 6.4 Proceed to the next sample or location; verify calibration before each measurement.

7.0 Quality Control

- 7.1 Document all calibrations and verification readings, including time and meter readings.
- 7.2 Run duplicate measurements on each batch or every 10th sample.

8.0 Maintenance

- 8.1 Check battery (if used in field); and replace if discharged.
- 8.2 After use in samples containing free oil, wash the electrode in soap and rinse thoroughly with water. Immerse the lower third of the electrode in diluted HCL (1:9) solution for 10 minutes to remove any film formed. Rinse thoroughly with water.
- 8.3 Keep electrode properly filled with appropriate filling electrolyte solution.

STANDARD OPERATING PROCEDURE FOR FIELD DETERMINATION OF CONDUCTIVITY, METHOD 205

GROUND WATER, SURFACE WATER AND WASTEWATER

1.0 Method Summary

- 1.1 Conductivity is a numerical expression on aqueous solution's ability to carry an electric current. This is dependent on the presence of ions, their concentrations, mobility, valence, and on the temperature of the solution.
- 1.2 The conductivity probe is immersed in a sample and the conductivity is read directly off of the meter scale.

2.0 Interferences

- 2.1 Temperature greatly influences the electrolytic conductivity of a sample, therefore, it is extremely important accurate temperature measurements are made.

3.0 Instrumentation

- 3.1 Conductance meter YSI Model 32.

4.0 Materials and Reagents

Conductivity cell

Thermometer

Specimen containers

5.0 Standard

- 5.1 Primary Working Standard:

Potassium chloride standard 0.01N: dissolved 0.7456 g anhydrous KCl in deionized water and dilute to 1 liter at 25°C. Conductivity = 1,413 umhos/cm.

6.0 Calibration

- 6.1 Check the conductivity of the standard prior to actual sample evaluation. Record the temperature of each standard.
- 6.2 Calculate the conductivity at 25°C making adjustments for the temperature (see 8.1 for equation).

7.0 Procedure

- 7.1 Rinse the cell with deionized water.
- 7.2 Measure the conductivity of each sample by swirling the cell in a portion of the sample. Record the conductivity reading and the temperature. Collect three conductivity readings until the readings are within ± 5 umhos/cm.
- 7.3 Calculate the conductivity at 25°C as outlined in Section 8.1.

8.0 Calculations

8.1 Conductivity at 25°C =
$$\frac{K}{1 + 0.0191(t-25)}$$

K = measured conductivity
t - temperature of sample, °C

9.0 Quality Control

- 9.1 Document all calibrations and verification of readings including time and meter readings.
- 9.2 A blank of deionized water is run and should have a conductivity of less than 5 umhos/cm.
- 9.3 The initial standard is checked in between samples.
- 9.4 Duplicate measurements of conductivity will be taken at least once for every 10 investigative samples

STANDARD OPERATING PROCEDURE FOR FIELD DETERMINATION OXIDATION/REDUCTION POTENTIAL (Eh)

GROUND WATER, SURFACE WATER AND LEACHATE ANALYSIS

1.0 METHOD SUMMARY

This is a measurement of the activity of the electrons in aqueous solution by potentiometric measurement. The Eh is read directly in millivolts (mV).

2.0 INSTRUMENTATION

Beckman pH ion meter

Eh probe

3.0 MATERIALS AND REAGENTS

Sample cups

Deionized water

Eh Standard Solutions

4.0 CALIBRATION

Calibrate the instrument according to the instruction manual included with the instrument.

1. Depress the CLEAR key to clear the instrument.
2. Set scale to mV.
3. Rinse the electrode and immerse in deionized water. The instrument should read 0.0 mV.
4. The instrument is now ready to make a Eh measurement. Rinse the electrode with distilled water and immerse in the sample.
5. Depress the mV key. Wait until the AUTO symbol flashes and then locks. The DISPLAY will indicate the measured temperature and Eh.
6. This sequence can be repeated for additional Eh measurements. Depress the mV key, wait for AUTO READ to lock, and note the Eh and temperature values.

5.0 PROCEDURE

1. Prepare and analyze samples without delay. Be careful not to aerate sample.
2. Place about 50 mls of sample into a plastic cup and stir slowly with the Eh probe.
3. Allow the Eh reading to stabilize. Collect three Eh readings from each sample and measure the temperature of the sample at the time each Eh reading is taken. Record the Eh and temperature values on the well or surface water sampling record form. Rinse the probe with distilled water and verify calibration by submersing in distilled water as described in 4.3.
4. Proceed to the next sample or location; verify calibration before each measurement.

6.0 QUALITY CONTROL

1. Document all calibrations and verification readings, including time and meter readings.
2. Run duplicate measurements on each batch or every 10th sample.

FIELD FILTERING

A representative water sample is poured into the upper section of a filtration unit and filtered through a 0.45 μ m membrane filter by means of a vacuum applied to the lower receiving section of the unit.

Analysis Rate:

Typically, a sufficient sample quantity for laboratory analysis can be field filtered in approximately 15 minutes.

Materials and Apparatus:

Disposable filter units having a capacity of 500-1,000 ml with a 0.45 μ m cellulose nitrate membrane filter (Nalgene 450-0045, 127-0045, or equivalent).
Hand vacuum pump
1/4" ID Tygon tubing (approx. 2 feet)

Procedure:

Open the top of the filtration unit and pour in approximately 25 mls of sample. Attach the hand pump to the hose nozzle on the unit. Slowly apply a slight vacuum to begin filtration. When the 25 ml aliquot is filtered, open the unit and discard the filtrate. Next, disassemble the unit and filter a quantity sufficient to fill the necessary sample bottles.

If the filter should become clogged or impervious, discard the unit and start the process over with a new unit.

Be sure to use a new filter unit for each sample location.

Quality Control:

During the sample collection and filtration process, a periodic decon blank will be generated by filtering reagent grade water through a filtering unit in the same manner as a sample. This blank should be tested for all constituents of interest.

In-Line Filtration:

A disposable 0.45 micron filter cartridge will be used for in-line filtering. The device will be attached to the sample pumping device (either the sampling pump or a peristaltic

pump) by means of silicone tubing. If the filter is attached directly to the sampling pump, it will be attached immediately after well purging has taken place.

The filtering procedure will proceed as follows:

- The sample will be placed in a 1 liter glass bottle.
- The filter cartridge will be attached to the discharge pump by means of silicone tubing.
- The discharge tubing and filter will be held upward so that air can be purged from the filter and tubing during the initial pumping.
- Fill the appropriate sample bottles with filtered water.
- Discard filter and silicone tubing.
- Record in the field log book the following information, sample location, date, time, and the individual's name performing the filtering. Record the manufacturer and size of filter.

**FIELD DETERMINATION OF TEMPERATURE
FOR
GROUND WATER AND SURFACE WATER**

1.0 INSTRUMENTATION

Thermometer
Plastic Container

2.0 PROCEDURE FOR ACTUAL TEMPERATURE MEASUREMENT

- 2.1 Place the thermometer in the sample.
- 2.2 Agitate the thermometer in the sample for one minute.
- 2.3 Read the temperature directly off the scale etched on the thermometer.
- 2.4 Repeat until three consecutive readings are obtained.
- 2.5 Take one duplicate reading every ten temperature measurements.
- 2.6 Rinse the thermometer in clean water after use.
- 2.7 Record in field log book the following information; Sample ID, date, time, and Sampler's name. Record the measurement taken and manufacturer of thermometer.